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RECORDS OF AGRICULTURAL PROJECTS KNOWN TO HAVE FAILED THROUGH PLANT DISEASES

"The history and the geography of disease are inseparable themes. Historical-geographical studies in pathology can be of great importance for many investigations."

The foregoing quotation from "Problems of Historical-Geographical Pathology," by H. E. Sigerist, in the Bulletin of the Institute of the History of Medicine, Volume 1, Pages 10-18, 1933, (Supplement to the Bulletin of the Johns Hopkins Hospital, Vol. 52, No. 1, Jan. 1933), was written with particular reference to the study of human diseases. It applies, however, with equal force to studies of plant diseases. Fruitful as experimental studies of the factors believed to influence the severity and spread of plant diseases have been and should continue to be, these experimental findings can be really checked as to their practical significance only by more extensive studies of the actual incidence of diseases in the past as well as in the present.

The records of plant disease incidence and of crop losses due to disease, accumulating year by year in the files of the Plant Disease Survey, constitute a sort of "current history" of the plant diseases in the United States. To these files or to our published records should be added such information as is obtainable regarding notable disease losses of earlier periods. No doubt the most complete and accurate of the records are those relating to the destructive outbreaks which follow the introduction of new parasites into the United States. Somewhat less complete but from some points of view more interesting are the fluctuations in severity of diseases long present in a locality. While the minor fluctuations are difficult to measure we should be able to record the severe ones in sufficient detail so that if similar outbreaks occur in the future it will be possible to compare conditions both as to severity of incidence and environmental factors.

There is another type of historical record well worth preserving as an indication of the natural range of disease and for its immediate practical importance, namely, the record of plant projects which have failed largely through the disease factor.

Somewhat more than a year ago the Plant Disease Survey requested from pathologists in various States reports of instances in which entire crop projects had failed due to plant diseases for which no adequate means of control was known. As these reports came only from the more experienced pathologists they are no doubt highly reliable and are here published for their historical value. That partial control has since been secured in some instances in no way detracts from the historical interest of the records.

It is only fair to state that some of our correspondents have suggested that the publication of such information might be used to discredit plant pathology by admitting failure to control any disease under any circumstances. It is felt, however, that compiling records of the failure of crop projects due to plant disease is a proper function of the Plant Disease Survey, and furthermore that the information so published may be very useful in avoiding extraordinary disease hazards.

Some comments by collaborators are given on the following pages. Further reports on this question are requested.

WASHINGTON: F. D. Heald, Feb. 8, 1933.

The failure of sugar beet production in the central irrigated valleys of the State, especially the Yakima Valley somewhat recently and somewhat earlier in the Palouse country, is one of the most striking examples. The severity of the curly top (virus) is the principal factor which led to the abandonment of a considerable number of commercial plants.

The growing of tomatoes in this same area, while not a complete failure, is very hazardous since in many seasons there may be almost complete failures in certain localities.

A few years ago an extensive planting of sweet potatoes was made in the Kennewick District with rather pronounced failures. Our data on this crop are incomplete, but it seems that a number of different diseases were responsible for the losses.

The last notable illustration of a failure was in rather extensive plantings of apple orchards in the vicinity of Spokane under irrigation and in a number of upland localities farther to the South. Nearly all of these orchards which were in existence fifteen years ago have disappeared. There are a number of causes for this, one of these being the utilization of soils of very poor water-holding capacity which predispose to winter injury. In one region the area selected proved to be a very decided frost pocket, which invariably suffered from late spring frosts. In the Spokane area in particular the winter injury was followed by the silver leaf disease (Stereum purpureum) which helped very materially to complete the work of destruction.

OREGON: H. P. Barss, July 25, 1933.

European brown rot (Sclerotinia cinerea), in humid western Oregon, is so destructive to common apricot and almond varieties as a blossom and twig blight as to render their culture in this region hazardous unless the grower is prepared to apply a most energetic and properly timed spray program, a program likely to be obstructed often by the weather conditions that favor infections just as the blossoms open. This disease is probably the natural explanation of the non-development of a commercial apricot culture in the Willamette Valley.

Sycamore anthracnose (Gnomonia veneta) was unknown in Oregon for many years after I came into the State in 1912. A few years ago it showed up attacking shade trees of considerable age in Corvallis. It has now practically ruined trees of all ages of the American plane tree (Platanus occidentalis). The London plane tree (Platanus orientalis var. acerifolius), although much less susceptible, suffers severe leaf damage in some years. Willamette Valley weather conditions in the spring apparently favor infections from this disease almost every year. There would probably be no hazard in eastern or southern Oregon but severe hazard in the Willamette Valley and Coastal areas for all but highly resistant or immune sorts of plane trees, if such are known.

Hop downy mildew (Pseudoperonosphora humuli). Only time will tell whether it will prove economically possible to continue hop production in the Puget Sound region of Washington in the presence of this recently introduced disease unless immune varieties suitable to that region are developed. The disease will probably not eliminate hop growing from any western Oregon localities but may, in certain low-lying yards, cause repeated damage of considerable intensity until resistant varieties are developed.

Curly top virus, Eutettix tenellus, vector. Eastern Oregon is a natural breeding ground for the curly-top leaf hopper. Its presence renders the growing of such crops as beets, tomatoes, squash, pumpkin and beans commercially impracticable because of the extreme hazard of the disease in the average year. There have been developed a few resistant varieties of beans and squashes which can be grown safely in this region but most varieties of these vegetables are ruined if the insects drift from the sagebrush into the fields when the young plants are coming up.

Crown rust (Puccinia coronata). The growing of oats is hazardous on account of crown rust in the narrow coastal strip of Oregon except for a few resistant varieties adapted to the climate. The rest of Oregon is practically free from this disease, however.

CALIFORNIA:

C. E. Scott, Feb. 1, 1933.

Alfalfa is becoming unprofitable in the San Joaquin Valley because bacterial wilt (Aplanobacter insidiosum) shortens the life of the stands. Dairymen are rapidly turning to substitutes. Districts growing alfalfa for market suffer a greater loss as they have no substitute.

Much of the land in the San Joaquin Valley is limited to nematode (root-knot) resistant crops or those plants which may be matured early in the season. I believe that the root-knot nematode (Heterodera marioni) is the most serious pest in this State.

Large areas in southern California cannot be used for sugar beet production because of the sugar beet nematode (Heterodera schachtii). This is true of course of a number of other States.

Verticillium wilt has rendered considerable land in the Santa Clara Valley unsuitable for certain crops. Strawberries, raspberries, and stone fruits, particularly apricots, are subject to great loss when planted in land that has produced tomatoes. Tomatoes are believed to be largely responsible for introducing and building up the disease in the Santa Clara Valley.

Harold E. Thomas, Jan. 30, 1933.

First I might mention the oak root fungus (Armillaria mellea). This disease follows the oak rather closely and attacks many kinds of fruit trees that are set out in land cleared of oaks but more particularly species of Prunus. At the start the spot is usually small but with years it grows and in many orchards there is an acre or more in the affected area at the present time. Since we have no practical or adequate means of control the fungus continues to spread and constitutes a serious menace in orchard growing.

The second disease that might fall within your classification is strawberry yellows (virus). In the coastal section of central California it is practically impossible any longer to grow the Banner variety and obtain profitable yields because of this disease. They have changed over to growing the Nich Ohmer variety which is a berry of much inferior quality. Because of the poor quality fruit that is produced on a diseased Banner plant and also because of the inherent poor quality of the Nich Ohmer variety the consumption of strawberries in San Francisco during the last ten years is reported to have fallen from 120,000 chests to 80,000 chests annually. We believe this decrease in consumption is largely due to the direct and indirect effect or yellows for which, of course, there is no adequate means of control.

H. S. Fawcett, Nov. 23, 1932.

The curly top of the sugar beet is a disease which made it practically impossible to grow this crop profitably in certain localities in southern California.

Professor Horne has mentioned to me the case of papaya in southern California becoming unprofitable because of the attack of a root rot probably due to Pythium.

MONTANA: P. A. Young, Feb. 27, 1933.

Only one disease in Montana meets the specifications of your letter. It is Helminthosporium foot rot of wheat and barley (H. sativum) which usually damages winter wheat and sometimes damages spring wheat and barley. Severe epidemics occurred in winter wheat in central Montana in 1913 and 1928. Proper dates of planting usually keep damage from foot rot below 25 per cent and as low as 5 per cent.

NEVADA: P. A. Lehenbauer, Feb. 17, 1933.

About 1913 the growing of sugar beets was promoted in Churchill County, near Fallon, Nevada, in the Newland's Reclamation Project, and a large sugar-producing plant was built near Fallon. Hundreds of acres were planted. After a few years it came to an end because curly top got the beets.

Several years ago, about five years ago, the sugar plant was taken over by another firm and sugar beets again were grown. After a season or two the project again collapsed - curly top again got the beets.

NEW MEXICO: R. F. Crawford, Feb. 13, 1933.

In the Mesilla Valley it is absolutely impossible to raise sugar beets due to the curly top disease. In fact, this area is one of the very few areas where we get practically 100 per cent infestation with curly top each year.

Western yellow blight of tomatoes (now of course recognized as identical with curly top) is also a limiting factor in tomato production.

Psyllid yellows of potatoes has recently been found in the Mesilla Valley. This disease appears to be the limiting factor in the successful production of potatoes in this valley.

Phymatotrichum omnivorum occurs very commonly in the Pecos Valley of New Mexico, and is causing a large loss to shade trees and other ornamental plants as well as attacking cotton and alfalfa.

We also have an undetermined species of Fusarium attacking alfalfa in the Pecos Valley. So far we have not been able to control this fusarial wilt of alfalfa, and it appears to be increasing in severity each year in the Pecos Valley.

ARIZONA: J. G. Brown, Jan. 24, 1933.

We have large areas infested with the Texas root rot fungus (Phymatotrichum omnivorum) which should be planted to grains and sorghum for several years in order to prevent them from becoming useless for tap-rooted crops. The disease is the outstanding case in this State; it is especially important, since it affects alfalfa, cotton, and deciduous fruit trees besides many other important plants.

Special crops which are so seriously attacked that their attempted cultivation is risky are deciduous fruits at the lower altitudes (near sea-level to 3,000 feet) and lettuce in patchy spots of a few acres. If a third of the deciduous fruit trees had lived that were planted in the Salt River Valley, one would now ride through a forest of trees in traversing the Valley. Instead there are only a few small orchards which are in a healthy condition. I have known orchards to be entirely destroyed by crown gall and others by Texas root rot. Now nematodes are coming in rapidly to add to the destruction.

TEXAS: J. J. Taubenhaus, Feb. 3, 1933.

I do not have to go very far in pointing out the setbacks to various communities due to specific plant diseases. When I first came to Texas in 1916, I was asked to work on watermelon wilt (Fusarium niveum). At that time, Waller County was one of the most important of the watermelon growing sections in the State. As a result of the watermelon wilt, the watermelon industry in that region has dwindled down to very little. The same is now occurring in other counties where watermelon wilt was introduced. In this connection we are testing out some of the wilt-resistant varieties which have been developed in Iowa.

Another instance is the cotton root rot or Phymatotrichum omnivorum. I know of many instances where sweet clover, alfalfa, and a number of other well worthwhile legumes have been completely wiped out due to this root rot. In a well-balanced system of rotation, legumes are badly needed and unfortunately most of these are susceptible and make a well-balanced system of farming very difficult. Another instance I have in mind is the difficulty of growing crops such as apples, etc., due to the undue susceptibility to Phymatotrichum root rot, and yet several attempts have been made in various sections of Texas to grow these crops which wound up a total failure. Lack of control measures for certain plant diseases is undoubtedly a great drawback to productive farming and if such diseases are kept in mind in the planning or development of new territory much grief could thus be prevented.

ARKANSAS: V. H. Young, Jan. 27, 1933.

There are parts of the Ozark region of northern Arkansas that would be ideal for apples were it not for the fact that cedars are so plentiful and so valuable from a timber point of view that it is not feasible to eradicate them for the control of cedar rust (Gymnosporangium spp.). No widespread commercial planting has gone on in such regions in recent years but we hear of isolated plantings being contemplated or advised and are forced to warn against it.

KANSAS: L. E. Melchers, Feb. 13, 1933.

Asters, because of the yellows (virus) can not be grown at all satisfactorily in the State. Cucumbers are not a profitable crop because of mosaic (virus) and the fact that the climatic conditions such as dry weather are almost always sure to injure the crop. Sweet potatoes are very badly damaged because of the infestation of many acres with wilt or stem rot (Fusarium spp.). The same holds true for watermelon wilt

(Fusarium niveum) and cabbage yellows (F. conglutinans). In the case of the latter examples, there are, of course, some resistant varieties which will give a fair yield and a crop of some value. In the case of sweet potato stem-rot, watermelon wilt, and cabbage yellows, there is still land available which has not been in these crops where satisfactory results can be obtained.

Then there are several other diseases which could be fairly well controlled if careful practices were followed, but in most cases they are not followed as they should be, with a result that a great deal of loss occurs. I have reference to blight of apple (Bacillus amylovorus). Pears, of course, are not a commercial crop in this State. Then there is the case of the cedar apple rust (Gymnosporangium juniperi-virginianae) which has been increasing in severity in Kansas in the last ten years. Little care has been taken in the past in selecting varieties and in the use of non-susceptible wind breaks.

ILLINOIS: H. W. Anderson, Jan. 26, 1933.

It seems to me there are two factors which enter into this discussion: One, the question of an entire failure of the crop in question due to the disease situation and the other, the cost of producing a crop free of disease. As an example of the last factor, I might cite the fact that some of our southern Illinois apple growers apply as many as 13 sprays in a season in order to get reasonably clean fruit. With apples in the neighborhood of 50 cents per bushel it is evident that they will lose money. This is one reason why early apples only are profitable in southern Illinois.

The only really good example which I can give you of the entire failure of a crop is fire blight on pears (Bacillus amylovorus). No one in the State has made money on pears aside from those who are growing Kieffers. Kieffers are produced on very cheap land with practically no care so that if the growers can sell them at from 30 to 50 cents a bushel they can make some money. A great many growers have attempted to produce orchards of mixed varieties of pears and in every case they have lost money. There is, of course, an excellent local market for good pears and a great many growers year after year attempt to grow a few trees of the better varieties.

INDIANA: M. W. Gardner, Jan. 27, 1933.

The cucumber mosaic disease has driven the pickle crop out of one locality after another in Michigan, Indiana, and Wisconsin. The average life of a salting station is said to be about 12 years, after which mosaic, and to a lesser extent, other diseases, become so bad that the growers won't sign contracts and the salting station must be abandoned with considerable resultant expense to the pickle company. I don't think the virus travelled with the crop, at least not with the seed, but rather believe that it was present in other hosts.

Nearly all of the good watermelon soil in Indiana is wilt-infested and any attempt to revive that industry would be disastrous, I believe. The good soil is largely limited to sandy ridges along the rivers, so there is not much that has not been previously used until it was thoroughly wilt-infested.

Any attempt to raise pears commercially in Indiana would be very likely to meet disaster because of blight.

ALABAMA: James L. Seal, Feb. 6, 1933.

We have one crop which certainly would come in the class of hazard crops. In Alabama we have been recommending the use of winter cover crops, such as Austrian peas and vetches. These plants have given excellent results some years and very poor results during others. So far as I am able to determine, various diseases may account for these failures. There seem to be several organisms involved, such as Ascochyta, Mycosphaerella, Rhizoctonia, and nematodes. Without question, some of these organisms are carried from year to year in and on the seed, and there is no adequate method of control known.

FLORIDA:

W. B. Tisdale, Jan. 3, 1933.

The first outstanding case in Florida is the pineapple. Although attempts were made to grow this crop in the State several years ago, I have been informed that it was started as a promotion project without consulting anyone concerning the diseases which might affect the crop. The project was comparatively short-lived and efforts have been made since then to revive it, but so far as I have learned, these efforts have been about as fruitless as the ones during earlier years.

Another project was started three years ago on muck soil in Sarasota County where commercial concerns attempted to grow tomatoes and cucumbers under cloth. This was started on a forty acre basis and, as I saw the layout, it was a very expensive experiment. Both crops failed miserably because of diseases which under ordinary outdoor conditions had given little concern in the locality.

Another recent one is connected with the Gerbera daisy. This has been started in a number of localities in the State as a promotion proposition, but has met with disaster. Of course, we as plant pathologists knew very little about the diseases to which the Gerbera daisy is subject, but I think that we would have been prepared to offer some suggestions had we been approached on the matter.

H. S. Fawcett, Nov. 23, 1932.

It would seem that the giving up of the lemon industry in Florida in the early days was in great part due to the great expense and difficulty of controlling scab (Sphaceloma citri). There were other factors such as the tendency for the lemons to grow too large for the market in Florida, but I believe scab was one of the main factors.

The growing of the Temple orange was a failure in the central part of Florida on account of it having been planted extensively on the wrong rootstock, namely, the rough lemon. This, however, may not be a real case of disease.

SOUTH CAROLINA: George M. Armstrong, Feb. 2, 1933.

One instance where a plant disease almost proved disastrous to a new industry has come to my attention in my four years' experience at Clemson. A new canning industry, The South Carolina Packing Corporation, began operations at Fairfax in 1929. Canned beans were to be a major product the first year and some 1,000 or 1,200 acres of beans were planted by the farmers in the vicinity to supply the cannery. A serious outbreak of anthracnose (Colletotrichum lindemuthianum) occurred and at least one-third of the beans were lost due to the ravages of this disease. The loss was easily $50,000. It was a clear cut case of the introduction of the disease on the seed. Since that time the officials of the canning plant have been most careful as to the source of seed but their lack of knowledge of the danger almost proved disastrous to a new and struggling industry.

DELAWARE: J. F. Adams, Feb. 2, 1933.

Spring oats, regardless of variety with the exception of the 60-day, are a complete failure under our conditions and the bacterial leaf spot (Bacterium coronafaciens) is the most important contributing factor along with moisture and temperature conditions unfavorable to this host. Spring wheat is also out of the question because of adverse weather conditions along with leaf rust (Puccinia triticina).

In the fruit line, Bartlett pears are a failure because of unfavorable climatic conditions and blight. None of the Vinifera group of grapes is adaptable under our conditions. Two years ago we endeavored to learn something of the Persian melon and found it was so highly susceptible to anthracnose (Colletotrichum lagenarium) under our conditions that spraying or dusting was not sufficient to check the disease. The Honey Dew melon is somewhat in the same position.

NEW YORK: M. F. Barrus, Nov. 17, 1932.

Violet. The double variety Farquhar was grown at one time in 1910 and before at Rhinebeck, New York, in large quantities and shipped all over the country, the height of the trade being at Easter. At the present time this double violet is but little grown there. Dr. Reddick states that the loss from Thielavia root rot (Thielava basicola) was causing trouble in 1910 and a grower from Rhinebeck has stated recently that the disease had ruined that industry.

Grape. As late as 1905-07, Concord grapes were grown extensively on the eastern side of Cayuga Lake and Niagara grapes on the western side. At that time for a period of years black rot (Guignardia bidwellii) and downy mildew, (Plasmopara viticola) became very destructive and caused so much damage that the vineyards on the eastern side gradually disappeared so that now there are no commercial vineyards there and relatively few on the western side. At the time the diseases were so severe, the growers were unacquainted with control measures (reported by Reddick).

Bean. Mosaic became so general on Navy Pea and on Blue Pod Medium beans in Genesee, Orleans, Monroe, and adjoining counties about 1918 and cut the yields so much that the acreage of beans became materially reduced and these varieties were almost or quite abandoned. A few years later the Robust pea bean, resistant to mosaic, was very generally planted by pea bean growers and the acreage planted to pea beans increased. Halo blight (Bacterium medicaginis phaseolicola) became especially severe on Red Kidney beans about 1925 and affected the production of this variety thereafter for several years. The use of California seed for the past several years has given good yields (See Young, H. N. Production and Marketing of field beans in New York. New York (Cornell) Agr. Exp. Sta. Bul. 532. 1931, fig. 9 and tab. 13 and 14 for data on acreage and production.)

Eggplant. This vegetable was once an important crop for vegetable growers of New York but the acreage has gradually decreased until now not more than 50 or 60 acres are planted in the entire State. Verticillium wilt (V. albo-atrum) has caused such severe losses that this must be considered as an important factor in the decline of this crop (Chupp).

Freesia. Six growers in the State have discontinued the growing of this plant, especially the variety Purity, because of the Fusarium corm disease.

Calla. Several growers on Long Island have discontinued this plant because of bacterial soft rot (Bacillus carotovorus) and Phytophthora root rot (Phytophthora sp.).

NOTE ON THE LONG BEACH EARTHQUAKE AND PLANTS

H. G. MacMillan

On the afternoon of March 10, 1933, at approximately 5:45 o'clock, an earthquake shook the area in and about Long Beach, California. There was some loss of life, widespread damage to structures and public property, with very considerable loss and inconvenience to many people. There was immediate relief for the afflicted people, strenuous efforts to repair public utilities in the damaged areas, restore communication and transportation, and a more gradual repair or restoration of damaged buildings and other property. As is commonly the case with earthquakes and disasters due to the forces of nature, attention is at first focused on the human suffering, later on the property damage, and finally on the more abstract and scientific aspects of the cataclysm.

This earthquake has been classified as a fairly strong, moderately large local shock. The land area seriously affected was roughly an ellipse with an axis about 45 miles long extending in a Northwest-Southeast direction, and a shorter Southwest-Northeast axis of about 12 miles. The land area affected may amount to 450 square miles, and the center of this area would be at some point north of Long Beach. The epicenter of the earthquake was situated in the ocean about 3 1/2 miles from Newport Beach, and about 17 miles southeast of Long Beach. The seismologists (5) have defined the earthquake as having reached an intensity of VIII (possibly XI) on the Modified Mercalli Scale of 1931, which specifies twelve grades.

A hundred years ago, Tschudi, a very competent observer travelling in Peru, wrote (4, p. 119) as follows:

> "The effect of earthquakes on the fertility of the soil is sometimes remarkable. Numerous observations tend to show that after violent commotions luxuriant lands often become barren wastes, and for several years produce no thriving vegetation. Several Quebradas in the Province of Truxillo, formerly remarkable for their fertility in grain, were left fallow for twenty years after the earthquake of 1630, as the soil would produce nothing. Similar cases occurred at Supe, Huaura, Lima, and Yca. All kinds of grain appear to be very susceptible to the changes produced by earthquakes. Cases are recorded in which, after slight shocks, fields of maize in full bloom have withered; and in the course of a day or two the crops have perished."

It will be noted here that Tschudi did not himself claim to observe the damage to the crops, but records something which had been reported to him. Humboldt (3) travelling between the years 1799 and 1804 in tropical South America, makes many references in his voluminous notes to the occurrence of earthquakes. He describes in some detail the terrible effects on buildings, the deaths that result, and the terrifying effect on the people, but omits any reference to destruction or damage to vegetation. As the regions in which Humboldt travelled were tropical and with abundant rainfall, any damage would be quickly covered by new growth. He did not visit in the Peruvian regions generally traversed by Tschudi so that the effects Tschudi reports did not come to his attention, or fall under his observation.

More recent writers make little or no mention of the effects of earthquakes on vegetation. The principal effect appears to be secondary, and is due to landslips or slides. Davison (2) in discussing avalanches says they are formed in hilly countries with every great earthquake. The Assam earthquake of 1897 was remarkable for the great development of avalanches. In one valley the steep hill sides were stripped bare, and the debris and broken trees piled up in the valley. The New Madrid earthquake of 1811-12, one of the greatest experienced in this country, caused slides along the bluffs of the Mississippi which are still conspicuous for a distance of 35 miles. A few years ago a landslide occurred on a mountain side in western Colorado. It was not associated with an earthquake, so far as is known. A large fan-shaped slide on which pine and chaparral were growing moved toward the valley. The trees originally in place in this area, if not tumbled at the time, gradually died even where appearing to stand in a more or less natural position in deep soil. The trees near the immediate area of the slip on the so-called "Moving Mountain" near Durango, Colorado, appeared to be dead a few weeks after the event. This phenomenon occurred in 1933. The death of the trees in both of these latter incidents appeared to be more from frictional heat than from shock, but nothing could be proven in either case.

In the earthquake area at Long Beach there was very unequal damage to structures. The most spectacular damage happened on, or was due to bad natural ground or made ground, or deep water-soaked alluvium or sand or to faulty structures. One of the centers of greatest damage was at

Compton, a city built on a flat alluvial plain. All of this plain is covered with vegetation. How the ground is affected can be surmised from the remarks of Wood (6) who reports that in various places water was ejected from cracks formed by the shock, and in numerous instances the water was charged with mud and sand. The flow of wells and springs was affected. There was a temporary increase in the flow, and in wells the water stood at a higher level than for some time. In a few cases the temperature of springs and ejected water was increased noticeably. In cultivated fields water flowed from newly opened cracks where water was not previously found near the surface. All of these instances were in alluvial soil in the severely shaken areas.

The effect of earthquakes on ground waters is considerable, as described elsewhere (1). It may have been that the crop losses Tschudi (4) reports were due to changes in water level. The ravines west of the Cordilleras in Peru, while often suitable for growing crops, would not have an excessive water supply.

It would seem that an earth shaking event of the kind at Long Beach would have some effect on the vegetation. The temperature of the ground waters was raised, indicating the development of frictional heat. The disturbance was not a gross effect alone in the shaken area, but every root and rootlet must have felt the shock. However, intermittent observations over the shaken area during the past year has revealed no injury to plants primarily due to the earthquake. There are a few trees which appear to be dying from gas injury such as would escape from a broken or cracked gas main. There were trees standing on a local fault that were injured. On growing crops there was no appreciable visible effect, either at the time of the quake or later.

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COLD WEATHER INJURY TO CROPS

PEACH CROP KILLED IN KENTUCKY: It seems evident that the sub-zero weather of the last days of February destroyed the peach crop of Kentucky, especially in eastern Kentucky, but from such evidence as we have at hand (March 3) there seems but little doubt that few if any peaches will be produced in the State this year. It is possible that in those areas where ice formed on the trees in advance of the zero and lower temperatures, buds may have been sufficiently protected to enable them to live through, and, with no further extremely cold weather, will produce fruit, but where no ice formed it is not likely that there will be blooms and consequently there will be no fruit. (Ben E. Niles, Sec. Ky. Hort. Society).

EFFECTS OF LOW TEMPERATURES ON GRAINS IN NORTH CAROLINA: There has been a deficiency of soil moisture during the past autumn. The drought has continued during the winter months. It has been so severe that many farmers have had to haul water from major streams for the farm because of low water in the wells. Many small streams even in heavily wooded areas had completely dried up, and were dry up to the first of February.

In Raleigh on December 30, the temperature reached a low of 15 degrees. Again on January 30, and February 10, lows of 8 degrees occurred. Temperatures approaching the extreme lows persisted for two days or more. They followed balmy weather and the drop was sudden.

The low of 15 degrees caused slight yellowing of all grains, which were not otherwise seriously injured. The low of 8 degrees practically killed all winter oats, and much of the wheat, rye, barley, and winter grasses. The grain fields throughout this State today all show the color usually attributed to the golden harvest. There is some evidence that some of the wheat, rye, and barley will revive but the injury will result in poor stands and serious stunting of these ordinarily cold-resistant crops. Plants were mostly killed back to the buds. The usual winter destruction of oats in the south results from thawing. This year it appears to be due to sudden freezing. Losses appear to be equally severe on all soil types throughout the State. (R. F. Poole, Feb. 19, 1934.)

DOWNY MILDEW OF SPINACH IN ARKANSAS

On January 12, V. H. Young reported the serious occurrence of downy mildew (Peronospora effusa) on spinach in Arkansas, as follows:

During the month of December we received several reports from Crawford and Sebastian Counties of damage to late crop spinach by downy mildew. This is the first report that either Doctor Rosen or I have received in some fourteen years. One of the vocational agriculture teachers states that losses were from one to fifteen per cent. In this connection, a letter from Mr. J. W. Myers of Van Buren, Arkansas, dated January 4, gives some rather interesting observations concerning the distribution of the disease.

"The canners call this disease 'blue mold' and state that spinach affected with it is not suitable for canning purposes.

"We first noticed this disease around Fort Gibson, Oklahoma, and Muskogee, Oklahoma. Later it developed around Spiro, Oklahoma, and at the close of our harvesting last week, we noticed a small amount of it around Van Buren, Arkansas. It occurred in thickly planted fields and where the soil was exceptionally fertile.

"Spinach has been a very profitable crop here for several years and we are worried about this disease."

Since this outbreak was located in the extreme western part of the State in the Arkansas River Valley, I wrote to the county agent of Phillips County, bordering the Mississippi where there is a small but important spinach area. He turned my letter over to G. O. Huggins, the secretary of the Barton Truck Growers Association. According to him the disease was severe this fall and is very important every year in the spring although no report has ever been received. He writes as follows (January 9):

"While we only have a small acreage here this fall the mildew has caused about 50 per cent loss and has proved much more damaging in the fall than in the spring. It seems to be increasing every spring, and is found on the same plot of ground each year."

NEW HOSTS FOR CHARCOAL ROT IN CALIFORNIA

Charcoal rot, Rhizoctonia bataticola (Taubenhaus) Butler, was reported by the writer (Phytopath. 26: 632-644, 1932) as occurring in California on common beans (Phaseolus vulgaris), blackeyes (Vigna sinensis), butter beans (P. coccineus), and an isolated occurrence on Henderson Bush (P. lunatus sieva). Since making this report charcoal rot has been found destroying sesame (Sesamum orientale), soy bean (Soja max), white lupine (Lupinus mutabilis), and occasionally on the large Lima (P. lunatus macrocarpa). There appears to be varietal resistance among the soy beans. In other countries over 50 species have been found as hosts for charcoal rot. An increasing number of hosts may be anticipated. (W. W. Mackie, Feb. 23.)

IRIS FLOWER SPOT

Gloeosporium cingulatum (det. C. L. Shear) was isolated from spots on flowers of Spanish iris (Iris xiphium) collected in May, 1933, in a Washington, D. C. flower garden. The plants were growing under a bush. The fungus isolated was used to inoculate greenhouse iris flowers of the Wedgewood variety by spraying a spore suspension on partly opened buds, without mechanical injury, and its pathogenicity was established. Visible infection appeared within two days, and spots typical of the original specimens, in three to four days. The spots caused by this

fungus are cinnamon rufous in color and distinctly zonate. They may occur along the margin of the falls and extend up into the throat of the petal. In both natural and experimental infections the spotting was severe, destroying the ornamental value and shortening the life of the flowers. (Thelma B. Post, Mar. 6).

NECTRIA CANKER ON HARDWOODS IN NORTHEASTERN UNITED STATES

D. S. Welch

In a survey covering about 65 widely separated forest areas in New England and New York, while on an emergency conservation work appointment in the Division of Forest Pathology during the summer and fall of 1933, it has been found that the Nectria cankers are the most common and serious diseases in the young stands of hardwood in this region.

The damage caused by this disease may vary from an occasional small infection to an extensive epiphytotic in which 60 to 80 per cent of the trees of a single species may be so badly damaged as to be worthless as crop trees. Severe injury of this type has been observed in black oak (Connecticut), white birch (New Hampshire), and basswood (New York).

In all cases reported here the fungus is of the type commonly referred to Nectria ditissima or N. galligena. Another less important group of canker diseases is attributed to N. cinnabarina, or its imperfect stage, Tubercularia sp.

There follows a list of the host plants upon which Nectria cankers of the first type have been found in New England and New York. Those marked with an asterisk * are here reported for the first time.

Acer

*pennsylvanicum (N. H., Vt., N. Y.)
*platanoides (Mass.)
rubrum (Me., N. H., Vt., Mass., Conn., N. Y.)
*saccharum (N. H., Vt., Mass., Conn., N. Y.)
spicatum (N. H., Vt., N. Y.)

*Amelanchier sp. (N. Y.)

Betula

alba papyrifera (Me., N. H., Vt., Mass., Conn.)
lenta (Vt., Mass., Conn., N. Y.)
lutea (N. H., Vt., Mass., Conn., N. Y.)
populifolia (N. H., Mass., Conn.)

Buxus sempervirens (N. Y.)

*Carpinus caroliniana (N. Y.)

*Carya glabra (Conn.)

*Corylus rostrata (N. Y.)

Fagus grandifolia (Me., N. H., Vt., N. Y.)

Fraxinus

*americana (N. H., Conn.)
nigra (N. Y.)

Juglans

*cinerea (Conn.)
nigra (N. Y.; Ontario, Canada)

Malus sylvestris (Me., N. Y.)

Nyssa sylvatica (Conn.)

*Ostrya virginiana (N. Y.)

Populus

grandidentata (N. H., Vt., Mass., Conn., N. Y.).
*tremuloides (N. H.)

Prunus

serotina (N. Y.)
*pennsylvanica (Vt.)

Quercus

alba (Mass., Conn.)
borealis maxima (N. H., Vt., Mass., Conn.)
coccinea (Mass., Conn.)
montana (Conn.)
velutina (Conn.)

Rhus typhina (N. Y.)

Sassafras variifolium (Conn.)

Tilia glabra (N. H., Vt., Mass., Conn., N. Y.)

Ulmus americana (N. Y.)